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|  |  CPG15(14)017 Annex IV-06 |
| CPG15-4 |  |
| Riga, Latvia, 25th – 28th March 2014 |  |
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| Date issued:  | 28th March 2014 |
| Source:  | CPG 15-4 |
| Subject:  | Draft CEPT Brief on WRC-15 Agenda Item 1.6 |
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| Summary:  |
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| Proposal: |
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DRAFT CEPT BRIEF ON AGENDA ITEM 1.6

1.6 to consider possible additional primary allocations:

1.6.1 to the fixed-satellite service (Earth-to-space and space-to-Earth) of 250 MHz in the range between 10 GHz and 17 GHz in Region 1;

1.6.2 to the fixed-satellite service (Earth-to-space) of 250 MHz in Region 2 and 300 MHz in Region 3 within the range 13-17 GHz;

and review the regulatory provisions on the current allocations to the fixed-satellite service within each range, taking into account the results of ITU‑R studies, in accordance with Resolutions 151 (WRC‑12) and 152 (WRC‑12), respectively.

# ISSUE

Resolution 151 (WRC-12)

“The WRC-12, considering

a) that the existing unplanned bands for the fixed-satellite service (FSS) in the 10-15 GHz range are extensively used for a large variety of applications, and these applications have triggered a rapid rise in the demand for this frequency range …

g) that there is a need to resolve the shortage of spectrum in Region 1 and Regions 2 and 3 …, such that the rapid growth of spectrum demand in considering a) could be met and the limited spectrum resources could be used in an efficient and economical way in accordance with the principle of Article 44 of the ITU Constitution …,

resolves to complete, for WRC 15:

i) studies of possible bands for a new primary allocation to the fixed-satellite service of 250 MHz in both directions in Region 1 within the bands 10-17 GHz, with particular focus on the frequency range that is contiguous (or near contiguous) to the existing fixed-satellite service allocations, taking into account sharing and compatibility studies, while protecting the existing primary services in the band(s); …”

Resolution 152 (WRC-12)

“resolves to complete, for WRC 15:

i) studies of possible bands for a new primary allocation to the fixed-satellite service in the Earth-to-space direction of 250 MHz in Region 2 and 300 MHz in Region 3 within the bands 13-17 GHz, with particular focus on the frequency range that is contiguous (or near contiguous) to the existing fixed-satellite service allocations, taking into account sharing and compatibility studies, while protecting the existing primary services in the band(s); …”]

# Preliminary CEPT position

Agenda Item 1.6.1:

СEPT supports the need for additional primary allocations of 250 MHz (Earth-to-space and space-to-Earth) to the GSO-FSS in frequency bands between 10 and 17 GHz in Region 1. Studies should demonstrate compatibility with the existing services before a primary allocation is to be made to the FSS in a particular frequency band.

Based on the sharing studies preliminary results, CEPT identifies the following frequency bands as possible frequency bands for a new primary allocation of 250 MHz to GSO FSS subject to development of possible mitigation technique if required (e.g. PFD mask, limitation of transmit antenna size, etc.).

FSS (space-to-Earth):

* 13.4-13.75 GHz with preference to the band 13.4-13.65 GHz for the gap between the up-link FSS allocations in the band 13.75-14.5 GHz;
* 14.8-15.35 GHz

FSS (Earth-to-space):

* [14.5-14.8 GHz]

For both, up- and downlink cases, as listed above, mitigation measures need to be implemented to protect the Space Research service in the bands 13.4-13.75 GHz, [14.5-14.8 GHz, ]14.8-15.35 GHz and RAS in the adjacent band 15.35-15.4 GHz (RR 5.340).

Moreover, the deployment of transmitting Earth stations for the ACES systems operating under the standard frequency and time signal-satellite would need to be ensured without additional constraint that may result from the protection of FSS receiving Earth stations.

CEPT does not support additional allocation to FSS in frequency bands 10.6-10.68 GHz and 15.35-15.4 GHz due to the difficulty of sharing with passive services operating in these bands.

Agenda Item 1.6.2:

CEPT supports a worldwide allocation for additional primary allocations (Earth-to-space) to the GSO-FSS in frequency bands between 13 and 17 GHz in all Regions.

CEPT considers that the additional allocation of 250 MHz to FSS (Earth-space) in Region 2 and 300 MHz in Region 3 in frequency bands between 13 and 17 GHz could be made only while ensuring compatibility with existing services in these frequency bands, in particular to radio services also allocated in Region 1.

CEPT does not support additional allocation to FSS (E-s) in the frequency bands 13.25-13.75 GHz and 15.35-15.4 GHz due to the difficulty of sharing with active and passive services operating in these bands.

# Background

During the last study cycle leading up to WRC-12, it was highlighted that there is a shortage of spectrum in all three Regions in Ku band which could not cope with the increasing spectrum demand. Furthermore, the existing unplanned bands for the fixed-satellite service (FSS) in the 10-15 GHz range are extensively used for a large variety of applications, and these applications have triggered a rapid rise in the demand for this frequency range. Europe alone demonstrates that the FSS spectrum in the 10-15 GHz range is effectively exhausted and becoming increasingly more congested resulting in more cases of harmful interference.

Therefore, to solve the Ku FSS spectrum shortage, the competent conference WRC-12 adopted Resolution 151 (WRC-12) and Resolution 152 (WRC-12) proposing to consider, as a matter of urgency, additional primary allocations to unplanned FSS to address the asymmetry in Earth-to-space and space-to-Earth FSS allocations in Regions 2 and 3, and also to consider possible additional primary allocations to the unplanned FSS (Earth-to-space and space-to-Earth) in Region 1.

It should be noted that a world-wide allocation to FSS has a significant advantage over a regional one. For example, unified FSS allocation in Regions 1 and 3 is important in terms of planning and designing of satellite networks, as well as achieving effective coverage area.

Also, in terms of improving spectral efficiency and convenience of communication system architecture, it is desirable that an additional spectrum for FSS be allocated in a continuous part of the spectrum that is contiguous to the existing fixed-satellite service allocations.

According to Resolution 151 (WRC-12) and Resolution 152 (WRC-12), studies of possible bands should be conducted for the purpose of identifying additional spectrum of 250 MHz to the fixed-satellite service (Earth-to-space and space-to-Earth) in frequency bands between 10 and 17 GHz in Region 1 and of 250 MHz to the fixed-satellite service (Earth-to-space) in Region 2 and of 300 MHz in Region 3 within the range 13-17 GHz.

The General working methods for compatibility studies are given in section 5, and Timetable of PT B is given in the Annex 1 to the document.

The preliminary results of compatibility studies are provided in Annex 3 to the document.

Frequency bands 10.5-10.6 GHz, 10.6-10.7 GHz, 13.25-13.4 GHz, 15.35-15.4 GHz and 15.4-15.7 GHz were considered in the previous study period for the sharing with MSS systems (See ITU-R Reports М.2221, М.2170, M.2229). Following protection criteria were used in the sharing studies mentioned above:

* 10.5-10.6 GHz - pfd level to protect RLS systems is required to be -146 dBW/m2 in 1 MHz;
* 10.6-10.7 GHz - interference pfd level for RAS systems is required to be -180 dBW/m2 in 1 MHz;
* 13.25-13.4 GHz - pfd level to protect aircraft ARNS systems is required to be -134 dBW/m2 in 1 MHz (or -158 dBW/m2 in 4 kHz);
* in the frequency band 15.35 – 15.4 GHz interference at the RAS receiver input in 50 MHz shall not exceed -202 dBW (or -219 dBW/MHz).

# List of relevant documents

Doc. 4A/468, Annex 09 - Working document towards a preliminary draft new (WD PDN) Report ITU-R S.[R1.FSS] – Assessment on use of spectrum in the 10-17 GHz band for the GSO fixed-satellite service in Region 1. This WD PDN Report ITU-R S.[R1.FSS] has been updated during the February 2014 meeting of WP 4A and provides material needed to support WRC-15 Agenda item 1.6.1, to consider possible additional primary allocations to the unplanned fixed-satellite service (FSS) Earth-to-space and space-to-Earth spectrum in the 10-17 GHz band in Region 1, as attached.

Doc. 4A/468, Annex 10 - Working document towards a preliminary draft new Report ITU-R S.[R2R3.FSS] - Assessment on use of spectrum in the 13-17 GHz range for the GSO fixed-satellite service in Regions 2 and 3. This WD PDN Report ITU-R S.[R2R3.FSS] has been updated during the February 2014 meeting of WP 4A and provides material needed to support WRC-15 Agenda item 1.6.2, to consider possible additional primary allocations to the unplanned fixed-satellite service (FSS) Earth-to-space spectrum in the 13-17 GHz band in Region 2 and Region 3, as attached.

Doc. 4A/468, Annex 11 - Working document towards a preliminary draft new Report ITU-R S.[FSS.DEPLOYMENT] – “Fixed-satellite service parameters and deployment in the 10-17 GHz band for the GSO fixed-satellite service” containing more detailed information on characteristics and deployment of FSS stations. This document provides more detailed information on characteristics and deployment of FSS stations that could be used in sharing studies. The single-entry characteristics for the FSS in the 10-17 GHz band as provided in Table 1, could be used to generate results based on the potential interference from one FSS Earth station while the FSS characteristics as provided in Tables 2-5 could be used to generate results based on cumulative interference (static & dynamic analysis) from all FSS Earth stations.

Doc. 4A/468, Annex 20 - Working document - Work Plan for WRC-15 Agenda item 1.6. This Work Plan provides preliminary Work Plan including General method of working for the sharing studies and Timeline. This Work Plan would need to be revised and updated, as appropriate, at every Working Party 4A meeting.

Doc. 4A/468, Annex 21 - Working document - Draft CPM text on WRC-15 Agenda items 1.6.1 and 1.6.2. This document provides, in its attachment, a preliminary text for the draft CPM Report to WRC-15 Agenda item 1.6. The attachment follows the structure developed during CPM15-1. The draft CPM text was updated at the WP4A meeting in February 2014.

# Actions to be taken

The following studies should be conducted for the purpose of allocation of additional spectrum of 250 MHz to the fixed-satellite service (Earth-to-space and space-to-Earth) in frequency bands between 10 and 17 GHz in Region 1, and of 250 MHz to the fixed-satellite service (Earth-to-space) in Region 2, and of 300 MHz in Region 3 within the range 13-17 GHz.

General list of necessary studies:

* Some remaining sharing and compatibility studies need to be conducted within the 10-17 GHz and 13-17 GHz bands in order to ensure protection from interference to:
* the existing services already having allocations in the above-mentioned frequency bands from the FSS;
* the FSS from the existing services.
* To provide studies on possible additional primary allocation to the fixed-satellite service of 250 MHz with particular attention to the band 14.5-15.35 GHz.
* Further studies for paired frequency band of 250 MHz the assessment of possibility of additional new allocation to FSS (space-to-Earth) in frequency band 10.0-10.5 GHz should be finalized. .
* Further studies for FSS (Earth-to-space) in frequency band 13.25-13.75 GHz should be finalized
* To continue compatibility study to assess the impact of existing systems towards the FSS satellite receiver or FSS Earth station receiver.
* In respect to the compatibility between SRS and FSS (space-Earth) further studies would be required to identify minimum orbital separation or other mitigation technique if applicable between DRS satellite and nearest FSS satellite for frequency band 13.4-13.75 GHz)…

# Relevant information from outside CEPT (examples of these are below)

## European Union (date of proposal)

## Regional telecommunication organisations

APT (July2013)

APT preliminary views on WRC-15 Agenda item 1.6.1, Doc. APG15-2/OUT-01, 04 July 2013:

APT Members support ITU-R to conduct studies on Agenda Item 1.6.1 in accordance with Resolutions 151 (WRC-12), while ensuring protection of existing primary services in the band(s).

APT Members are of the view that, if consideration is given to use of the 14.5-14.8 GHz band, there is a need to take appropriate measures to ensure the integrity and adequate protection of the AP30A Plan and List from any new fixed-satellite service utilization of the bands.

APT Members are of the view that, the bands 10.6-10.7 GHz and 13.25-13.75 GHz should be excluded from the candidate bands under Agenda item 1.6.1 to protect the EESS (passive) and EESS (active) respectively.

APT preliminary views on WRC-15 Agenda item 1.6.2, Doc. APG15-2/OUT-02, 04 July 2013:

APT Members support ITU-R to conduct studies on Agenda Item 1.6.2 in accordance with Resolutions 152 (WRC-12), while ensuring protection of existing primary services in the band(s).

APT Members are of the view that, if consideration is given to use of the 14.5-14.8 GHz band, there is a necessity to take appropriate measures to ensure the integrity and adequate protection of the AP30A Plan and List from any new fixed-satellite service utilization of the bands.

APT Members are of the view that, the band 13.25-13.75 GHz should be excluded from the candidate bands under Agenda item 1.6.2 to protect the EESS (active).

ATU (date of proposal)

Arab Group (December 2013)

WRC-15 Agenda Item 1.6.1: Follow up the current studies and ensuring the protection of the existing services without any obligations on them in the candidate bands indicated in draft ITU-R S. (R1 FSS).

WRC-15 Agenda Item 1.6.2 : Follow up the current studies and ensuring not to have any constraints on the existing services in Region 1.

CITEL (April 2013)

Initial position on WRC-15 AI 1.6.1: FSS 250 MHz in 10-17 GHz Region 1

Preliminary Views – None

Initial position on WRC-15 AI 1.6.2: FSS (E-s) 250 MHz in Region 2 and 300 MHz in Region 3 in 13-17 GHz

Preliminary Views

Brazil / Canada / United States / Mexico

Support studies towards consideration of possible additional primary allocations to the fixed satellite service (FSS) (Earth to space) of 250 MHz in Region 2 and 300 MHz in Region 3 within the range 13 - 17 GHz and review the regulatory provisions on the current allocations to the fixed satellite service within this range, in accordance with Resolution 152 (WRC-12), while protecting existing primary services in the band(s).

RCC (1 November 2013)

Agenda item 1.6.1

The RСС administrations support the additional primary allocation of 250 MHz to the FSS (Earth-to-space and space-to-Earth) in the range between 10 and 17 GHz in Region 1 subject to protection of existing primary services in these and the adjacent frequency bands.

Agenda item 1.6.2

The RСС Administrations consider that with the additional allocation of 250 MHz to the FSS (Earth-to-space) in Region 2 and 300 MHz in Region 3 in frequency bands between 13 and 17 GHz, protection of the existing primary services in these frequency bands, including those allocated in Region 1, shall be provided.

Agenda item 1.6.1 and agenda item 1.6.2

The new FSS allocations are preferable in frequency bands which are contiguous to the existing FSS allocations and also in bands, where the allocation is possible on the worldwide basis.

The RСС administrations consider that allocation of additional spectrum for the FSS on the worldwide basis (in the three Regions) has advantage over regional allocation (in one Region) for planning satellite communication networks and for providing effective territory coverage.

The RСС Administrations consider it necessary to study the methods of protection for SRS and RAS systems having allocations on a secondary basis, in the frequency bands of interest and in the adjacent frequency bands, ensuring the observance of the existing protection criteria for SRS and RAS from the impacts of the FSS systems.

The RСС Administrations do not support the allocation of frequency bands 10.6-10.68 GHz and 15.35-15.4 GHz to the FSS due to the complicated sharing with the passive services allocated to these frequency bands.

## International organisations

IATA (date of proposal)

ICAO (July 2013)

To oppose any new fixed satellite service allocation unless it has been demonstrated through agreed studies that there will be no impact on aviation use of the relevant frequency band.

IMO (date of proposal)

NATO (December2013)

Preliminary NATO Military Position as of December2013

1.6.1 - NATO does not support additional allocations to the FSS in the bands 10.0-10.5 GHz and 13.25-17.0 GHz. Recognizing resolves 4 of Resolution 151 (WRC-12), NATO supports focusing ITU-R studies in the frequency range 10.5-12.5 GHz (excl 10.7-11.7 GHz). NATO does not support the band 14.5-15.35 GHz to be allocated to the FSS for use by medium and high density applications (e.g. VSAT).

1.6.2 - NATO does not oppose possible additional primary allocations to the fixed-satellite service (FSS) (Earth-to-space) of 250 MHz in Region 2 and 300 MHz in Region 3 within the range 13-17 GHz provided that studies will show no impact to incumbent Services. NATO does not support the band 14.5-15.35 GHz to be allocated to the FSS for use by medium and high density applications (e.g. VSAT).

SFCG (July 2013)

SFCG supports the protection of existing space science service allocations. No additional allocation of spectrum to support FSS (Earth-to-space) should be made in space science service bands unless acceptable sharing conditions are agreed. There is particular concern with the possible allocation of FSS (Earth-to-space) in the 13.25-13.75 GHz band allocated to EESS (active). This band is used for active remote sensing (altimeters and scatterometers) by missions such as Cryosat, Jason-2, Jason-3, Jason-CS, Sentinel-3, and HY-2. Prior studies have shown incompatibility between these services. Therefore, SFCG supports no new allocation to FSS (E-s) in the band 13.25-13.75 GHz.

Other services to be protected are the SRS in the bands 13.4-13.75 GHz and 14.5-15.35 GHz and the EESS (passive) and SRS (passive) in the band 15.2-15.35 GHz.

The frequency band 13.4-13.75 GHz is used by DRS systems for forward inter-orbit links and for return feeder links. The frequency band 14.5-15.35 GHz is used by DRS systems for return inter-orbit links and for forward feeder links and also for wideband SRS downlinks to transmit high rate scientific data from LEO, GSO or HEO SRS satellites. The feasibility of sharing between this SRS links and FSS links requires further study using protection criteria of Recommendations ITU-R SA.609 and SA.1155 and technical characteristics of Recommendations ITU-R SA.1414 and SA.1626. In case an allocation to FSS is adopted in these bands, the SRS forward and return inter-orbit links and down links notified before WRC-15 must receive co-equal status with FSS.

WMO and EUMETNET (February 2013 / January 2013)

WMO opposes a new allocation to FSS in the 13.25 - 13.75 GHz frequency band.

WMO also opposes any allocation in the 10.6 - 10.7 GHz frequency band. WMO requires that protection of sensors in the band 10.6 - 10.7 GHz be ensured from unwanted emissions of FSS systems.

EUMETNET is strongly opposed to see any FSS allocations in the band 13.25 – 13.75 GHz.

## Regional organisations

ESA (July 2013)

Supports SFCG.

Eurocontrol (date of proposal)

EUMETSAT

Supports SFCG

CRAF (January 2013)

CRAF supports the protection of existing RAS allocations. No additional allocation of spectrum to support additional FSS use should be made in or near RAS allocated bands unless acceptable compatibility criteria are developed via appropriate studies and included in subsequent regulation

## OTHER INTERNATIONAL AND REGIONAL ORGANISATIONS

EBU (date of proposal)

GSMA (date of proposal)

1. Timetable for CPG PTB studies on WRC-15 Agenda item 1.6

In the Timetable for CPG PTB below, appropriate references are made to the sections of the general list of necessary studies (see section 5 of the Brief). This Timetable may be revised and updated, if required, at every CPG PTB meeting.

| CPG PTB meetings | Work plan  |
| --- | --- |
| [September] 2014 [prior to the deadline for completing the draft CPM text]  | * To prepare the text of the Draft European Common Proposals (ECP) for the work of the Conference (WRC-15).
 |
| May 2015 | * Finalize and agree on any remaining technical documents supporting the Draft CEPT Brief and the Draft European Common Proposals (ECP) for the work of the Conference (WRC-15) on Agenda item 1.6.
 |

1. Possible additional frequency bands for FSS allocation (Earth-space)/(space-Earth)

Table 1 Possible additional frequency bands for FSS allocation (Earth-space)/(space-Earth)

| **Frequency bands (GHz)** | **Bandwidth** **(MHz)** | **Current FSS allocation**  | **Previous studies for WRC-12[[1]](#footnote-1) preparation (link)** |
| --- | --- | --- | --- |
| 10.0-10.45 | 450 | no |  |
| 10.45-10.5 | 50 | no |  |
| 10.5-10.55 | 50 | no | WRC-12 AI 1.25 (s-E) |
| 10.55-10.6 | 50 | no | WRC-12 AI 1.25 (s-E) |
| 10.6-10.68 | 80 | no |  |
| 13.25-13.4 | 150 | no | WRC-12 AI 1.25 (s-E) |
| 13.4-13.75 | 350 | no |  |
| 14.5-14.8 | 300 | Yes, E-s, but it is limited to feeder links for the broadcasting- satellite service outside Europe (No. 5.510 RR), and subject to decides 2 Resolution 151  |  |
| 14.8-15.35 | 550 | no |  |
| 15.35-15.4 | 50 | no \*\* |  |
| 15.4-15.43 | 30 | no \* | WRC-12 AI 1.3, 1.21 (E-s) |
| 15.43-15.63 | 200 | Yes, but limited to feeder links of non-geostationary systems in the mobile-satellite service (No. 5.511A RR) | WRC-12 AI 1.3, 1.21, 1.25(E-s) |
| 15.63-15.7 | 70 | no \* | WRC-12 AI 1.21 (E-s) |
| 15.7-16.6 | 900 | no |  |
| 16.6-17.0 | 400 | no |  |
| \* Allocated for FSS networks which complete publication information was received by BR before 21 November 1997 \*\* No.5.340 RR is applied  |

Noting that previous studies for AI 1.25 (WRC-12) took MSS Earth Stations into consideration, however, FSS Earth station would have different parameters.

1. PRELIMINARY RESULTS OF COMPATIBILITY STUDY UNDER AI 1.6.1 WRC-15

Editor’s Note: The information provided in the Annex should be renewed and accumulated until all necessary study according to Resolution 151 (WRC-12) would be done. In present time one should understand that this information has a preliminary nature and aimed to create appropriate technical background for developing common CEPT position on AI 1.6.1 in future.

All possible additional frequency bands for additional primary FSS allocation (Table 1, Annex 2) could be divided for three continuous blocks: 10.0-10.68 GHz; 13.25-13.75 GHz and 14.5-17.0 GHz. To amend the development of CEPT countries position the additional analysis of European common applications in this block bands is provided below on ERC Report 25 basis. Though, it’s noted, any other application of primary radio service could be considered in the AI 1.6.1 studies in case of need according to Resolution 151 (WRC-12).

* 1. Possible additional frequency bands for FSS allocation in 10.0-10.68 GHz block



Note. Applications of primary radio services are shown in Roman type. Applications of secondary radio services or SRD applications are shown in italic type.

Fig. 1. European common applications in 10.0-10.68 GHz band according to ERC Report 25

* + 1. Frequency band 10.0-10.5 GHz
			1. FSS and RLS

Similar results as for the band 10.5-10.6 GHz are expected.

* + - 1. FSS and FS including SAP/SAB applications

The characteristics and protection criteria of PMP FS systems operating in frequency band 10.15-10.68 GHz are given in Recommendations ITU-R F.747 and F.1568. Preliminary results of compatibility studies showed that a probability of exceeding the long-term interference criterion Iag/N = −10 dB for PMP FS systems from FSS (space-to-Earth) is from [about 3% to 8%] when FSS (space-to-Earth) spectral density e.i.r.p. is 40 dBW/MHz. When FSS (space-to-Earth) spectral density e.i.r.p. is decreased to 36 dBW/MHz the probability of exceeding the long-term interference criterion for PMP FS systems is from about [0% to 1%].

* + - 1. FSS and RAS in adjacent frequency band

The emissions of FSS in the frequency band 10.0-10.5 GHz could cause interference to RAS receive stations operating in the adjacent frequency band 10.6-10.68 GHz. In accordance with Recommendation ITU-R RA.769 the threshold interference pfd level is –240 dBW/m2/Hz for continuum observations and –193 dBW/m2/Hz for VLBI observations. In order to protect RAS for VLBI observations and Continuum observations it is respectively required 58 dB and 12.1 dB limitation of the out-of-band emissions of FSS satellite in the frequency band 10.6-10.68 GHz. As these limits are exactly the same which are today already respected by satellites operating in the frequency band 10.70-10.95 GHz and above, sharing seems feasible between FSS (space-to-Earth) and RAS in adjacent frequency band.

* + - 1. Summary of studies for the band 10.0-10.5 GHz

With additional spectrum allocation to GSO FSS (space-to-Earth) on a primary basis in Region 1 in the frequency band 10.0-10.5 GHz the compatibility of the proposed GSO FSS (space-to-Earth) with RLS and FS in the common frequency band and also with RAS in the adjacent band 10.6-10.68 GHz will be difficult to achieve without the use of additional mitigation techniques.

* + 1. Frequency band 10.5-10.6 GHz
			1. FSS and RLS

The characteristics and protection criteria of RLS stations operating in the frequency band 10.5-10.6 GHz in Region 1 on secondary basis are given in Recommendation ITU-R M.1796. The issue of providing protection for G16, G17, G18 and G19 stations given in the indicated Recommendation is addressed in Report ITU-R М.2221. The pfd level of –146 dBW/m2 per 1 MHz is required for RLS station protection.

* + - 1. FSS and RAS operation in the adjacent frequency band

The results of sharing studies between FSS (space-to-Earth) and RAS, operating in frequency band 10.6-10.7 GHz, for the band 10.0-10.5 GHz are applicable to frequency band 10.5-10.6 GHz.

* + - 1. FSS and FS including SAP/SAB applications

The compatibility studies between FSS (space-to-Earth) and FS in frequency band 10.5-10.6 GHz are the same as in frequency band 10.0-10.5 GHz.

* + - 1. Summary of studies for the band 10.5-10.6 GHz

With additional spectrum allocation to GSO FSS (space-to-Earth) on a primary basis in Region 1 in the frequency band 10.5-10.6 GHz the compatibility of the proposed GSO FSS (space-to-Earth) with RLS and FS allocated in the shared frequency band and with RAS in adjacent frequency band 10.6-10.68 GHz will be difficult to achieve without the use of additional mitigation techniques.

* + 1. Frequency band 10.6-10.68 GHz
			1. FSS (space-Earth) and EESS (passive)

Preliminary statics studies propose to consider two criteria for EESS (passive) protection in 10.6-10.68 GHz. The first criterion is the acceptable interference power density received by the EESS sensor which is −166 dBW in the reference bandwidth of 100 MHz. This is a maximum interference level from all sources. The second criterion is the frequency of occurrence limit on the threshold being exceeded. These interference levels should not be exceeded for more than 0.1% of sensor viewing area (data availability of 99.9%) for measurement area defined as a square on the Earth of 10 000 000 km2. Study#1 on assessment of FSS (space-to-Earth) interference showed negative margins for EESS (passive) stations varying from –11 dB down to –21 dB when FSS (space-to-Earth) spectral density e.i.r.p. is assumed 46.10 dBW/MHz according to No. 21.16, Table 21-4, RR. Study#2 also showed negative margins for EESS (passive) stations varying from about 0 dB to –37 dB when FSS (space-to-Earth) spectral density e.i.r.p. is assumed -20 dBW/Hz (for elevation angle greater than 25 degrees; for other angles the pfd levels in Table 21-4, RR are assumed) and from about –6 dB to –42 dB when FSS (space-to-Earth) spectral density e.i.r.p. levels are assumed in accordance with RR Table 21-4.

* + - 1. FSS (Earth-space) and EESS (passive)

Concerning the interference from the proposed FSS (Earth-to-space) into EESS (passive) sensors in the 10.6-10.7 GHz band, the scenario of the single entry direct interference from proposed FSS earth station (Earth-to-space) into EESS (passive) was considered. The interference criterion to protect EESS (passive) sensors in Recommendation ITU-R RS.2017 was not satisfied even for the single entry direct interference from proposed FSS earth station (Earth-to-space) into EESS (passive).

* + - 1. FSS and RAS

In the frequency band 10.6-10.7 GHz the RAS stations are used for the continuum and very long baseline interferometry (VLBI) observations. In accordance with Recommendation ITU-R RA.769 the threshold interference pfd level is –240 dBW/m2/Hz for continuum observations and –193 dBW/m2/Hz for VLBI observations.

* + - 1. FSS and FS including SAP-SAB

The characteristics and protection criteria of PMP and PP FS systems are given in Recommendations ITU-R F.747 and F.1568. The study results concerning compatibility between FSS (space-Earth) and PMP FS systems in the band of 10.6-10.68 GHz are the same as 10.0-10.5 GHz.

Preliminary results of compatibility studies for PP FS systems showed that a probability of exceeding the long-term interference criterion Iag/N = −10 dB from FSS (space-to-Earth) links is from about 0.3% to 2.5% when FSS (space-to-Earth) spectral density e.i.r.p. is 40 dBW/MHz. When FSS (space-to-Earth) spectral density e.i.r.p. is decreased to 36 dBW/MHz the probability of exceeding the long-term interference criterion for PP FS systems is from about 0.02% to 0.9 %.

* + - 1. Summary of studies for the band 10.6-10.68 GHz

With additional allocation of spectrum to GSO FSS (space-to-Earth) on a primary basis in the band 10.6-10.68 GHz in Region 1, compatibility of the proposed GSO FSS (space-to-Earth) with passive services (EESS, SRS) and RAS, allocated in the shared frequency band, is not ensured.

Compatibility of proposed FSS (space-to-Earth) and FS in the shared frequency band 10.6 10.68 GHz is also impossible without the use of additional mitigation techniques.

* 1. Possible additional frequency bands for FSS allocation in 13.25-13.75 GHz block



Note1. Applications of primary radio services are shown in Roman type. Applications of secondary radio services or SRD applications are shown in italic type.

Note 2: The band 13.4-13.75 GHz is also allocated in the RR to the Standard frequency and time signal-satellite (Earth-to-space) on a secondary basis. The band 13.4-13.75 GHz is also allocated to the space research on a secondary basis for applications other than active sensors.

Fig. 2. European common applications in 13.25-13.75 GHz and adjacent bands
according to ERC Report 25

* + 1. Frequency band 13.25-13.4 GHz
			1. FSS (space-to-Earth) and EESS (active)

With regard to sharing between EESS (active) and FSS (space-to-Earth), 2 studies were performed showing compatibility between both services.

* + - 1. FSS (Earth-to-space) and EESS (active)

With regard to sharing between EESS (active) and FSS (Earth-to-space), 5 studies have been performed to date.

Three of the studies indicate that the EESS (active) protection criteria is always met for all kinds of sensors considered, assuming an FSS frequency reuse factor of 1.2. However, EESS (active) altimeters have lower margins of compatibility from 3 to 6 dB below protection criteria, than scatterometers and precipitation radars.

Another study indicates that FSS (Earth-space) with EESS (active) are compatible subject to some FSS (Earth-space) parameters restriction. According to the results of these studies, compatibility is achieved for all transmission types of FSS (Earth-space) earth stations with antenna diameters from 0.6m to 9 m with a maximum peak envelope power spectral density less than or equal to [-50.8 dBW/Hz].

The last study provides a parametric analysis varying the FSS GSO frequency reuse factor from an FRF of 1.2 to 4. According to the results of these studies, compatibility is achieved for all transmission types of FSS (Earth-space) earth statioan assessment of the simplifying assumption of using a single continuously transmitting earth station in place of a TDMA network was done, showing that this simplifying assumption underestimates the amount of interference seen by the JASON-3 sensor by 6 dB considering a 100% TDMA deployment across the three transmission types. Further study is required to assess the interference impact considering the simplifying assumption for different TDMA Deployment scenarios.

If the FSS satellite frequency reuse factor is increased to 3 or 4, compatibility is no longer ensured, noting that a frequency reuse factor of 1.2 ensures compatibility. Further assessment is required to determine a potential realistic future frequency reuse factor.

One of the studies also shows that, should specific areas of measurements of interest (sea/land/wet areas) be considered for satellite altimetry, instead of considering a worldwide area of measurement of interest, compatibility is not be achieved in a specific area. Further studies are required to evaluate such impact when considering different specific areas of measurements of interest.

* + - 1. FSS (space-Earth and Earth-space) and ARNS

The characteristics and protection criteria of the Doppler radars operating in the frequency band 13.25-13.4 GHz in the ARNS are given in Recommendation ITU-R M.2008. The indicated characteristics were applied in the sharing studies with MSS (space-Earth) given in Report ITU-R M.2221. It was shown that the pfd level of –134 dBW/m2 per 1 MHz (corresponds to –158 dBW/m2 per 4 kHz) is required for providing protection of ARNS radars.

A pfd level of –135.9 dBW/m2/MHz is necessary to protect the sense and avoid (S&A) system radar receiver from interference from the proposed FSS satellite downlinks in the 13.25-13.4 GHz band. In addition, the receiving FSS earth stations will receive substantial interference from the S&A radar transmissions.

For FSS (Earth-space) case studies show that, even when considering only the far side lobe levels of FSS Earth stations and two victim systems with non-worst-case characteristics, harmful interference would be created in Doppler Navigation Aids by one single FSS Earth station, with I/N levels up to 53 dB above the protection criterion.

* + - 1. FSS (space-Earth and Earth-space) and SRS

Since SRS (active) applications in frequency band 13.25-13.4 GHz are active sensors used around other planets no compatibility issue with FSS is expected.

* + 1. Frequency band 13.4-13.75 GHz
			1. FSS (Earth-space and space-Earth) and Active sensors (EESS)

The results of sharing studies between FSS (Earth-to-space and space-to-Earth) and Active sensors (EESS) for the band 13.25-13.4 GHz are applicable to frequency band 13.4-13.75 GHz.

* + - 1. FSS and SRS

The frequency band 13.4-13.75 GHz is also used by data relay satellite (DRS) systems operating in SRS for forward inter-orbit links (GSO DRS-to-NGSO user spacecraft (usually LEO)) and for return feeder links (GSO DRS-to-earth station). Recommendations ITU-R SA.1018 and ITU-R SA.1019 contain general descriptions and preferred frequency bands of DRS operating SRS. The protection criteria for the various links of data relay satellite systems are provided in Recommendation ITU-R SA.1155.The compatibility results are as follows.

* Sharing with the FSS space-to-Earth links could be ensured via mitigation techniques in particular due to limited number of operating DRS GSO satellites.
* Sharing is not possible with the FSS Earth -to-Space links without mitigation techniques.

Further studies would be required to identify minimum orbital separation between DRS satellite and nearest FSS satellite and other technical measures required in order to meet the aggregate interference criteria (Io/No level= – 10 dB in 0.1 % of time).

* + - 1. FSS (space-Earth) and RLS and RNS

Using a pfd limit shown below, the RLS and RNS with FSS (space-to-Earth) are compatible.



Where δ is the angle of arrival above the horizontal plane

It should be noted that these limits were derived using characteristics for RLS and RNS systems in 13.75-14.0 GHz band (see Recommendation ITU-R M.1644).

* + - 1. FSS (Earth-to-space) and RLS in 13.4-13.75 GHz

TBD

* + - 1. FSS (space-Earth) and FS and MS

Result of sharing studies between FSS (space-to-Earth) and FS and MS shows that compatibility is possible considering a pfd limitation between -125 dB(W/m2.MHz) and -102 dB(W/m2.MHz) for FSS (space-to-Earth) signal arrival angles from 0° to 90°.

* + - 1. FSS (space-Earth) and FS, MS in 13.4-13.75 GHz

Compatibility conditions between FSS (space-Earth) and FS, MS stations are possible based on pfd limits into FSS space stations.

* + - 1. FSS (space-Earth and Earth-space) and secondary SFTSS (Earth-space) in 13.4-13.75 GHz

The dynamic study 1 showed that 4,198 FSS Earth stations create an interference level of -125.4 dBW for 0.1% of the time in space station receiver, therefore not exceeding the protection criterion of –125 dBW/ 125 MHz by 0.4 dB. The dynamic study 2 showed that 10 650 FSS earth stations create an interference level of –117.4 dBW for 0.1% of the time, therefore exceeding the protection criterion by 7.6 dB. The dynamic study 3 indicated that a deployment of 60 cm FSS ES with power density levels of -50 dBW/Hz and -42 dBW/Hz showed harmful interference. However a FSS ES deployments of several bandwidths as well as FSS ES deployments using 60 cm antenna size with power densities of -55 dBW/Hz did not exceed the interference criteria.

No study was performed yet with regard to the impact of FSS downlinks in the ACES system. Due to the pointing of the receiver antenna towards the Earth, and the distance between the ISS and the FSS satellites it is expected that sharing would be feasible, but this has to be confirmed through additional studies.

In addition, the continuous deployment of transmitting Earth stations for the ACES systems would need to be ensured without additional constraint due to the protection of FSS receiving Earth stations.

* + - 1. Summary of studies for the band 13.4-13.75 GHz

TBD

Compatibility conditions between FSS (space-to-Earth) and SRS may be achievable in 13.4 13.75 GHz band using technical measures. Further studies would be required to identify minimum orbital separation between DRS satellite and nearest FSS satellite and other technical measures required in order to meet the aggregate interference criteria (Io/No level = – 10 dB in 0.1% of time).

* 1. Possible additional frequency bands for FSS allocation in 14.5-17.0 GHz block



Note 1. Applications of primary radio services are shown in Roman type. Applications of secondary radio services or SRD applications are shown in italic type.

Note 2. One administration use DRS and high data rate transmission systems within SRS allocation in the frequency bands 14.5-14.8 and 14.8-15.35 GHz, but this is not reflected in ERC Report 25.

Note 3. The frequency bands 14.62-15.23 GHz and 15.7-17.3 GHz are NATO harmonized bands and in general use in European NATO countries.

Fig. 3. European common applications in 14.5-17.0 GHz band according to ERC Report 25

* + 1. Frequency band 14.5-14.8 GHz
			1. FSS and BSS feeder links

The study 1 and 2 confirmed that it is technically feasible to make new unplanned FSS (Earth-to-space) allocation (beyond RR 5.510) in frequency band 14.5-14.8 GHz while protecting assignments in the Appendix 30A Plan and List Analysis with MSPACEg software demonstrated that by small adjustments to the orbital location of the FSS test system, EPM degradation could be maintained within acceptable limits. Static analysis using worst case assumptions demonstrated that the aggregate protection ratio of 30 dB for feeder links in the WRC-97 Plan could still be satisfied with multiple FSS systems. Required coordination procedures need to be developed. In order to ensure protection of the Plan and List assignments from new FSS (Earth-to-space) links, coordination triggers need to be defined. Three coordination triggers, power flux density (PFD), ΔT/T, and C/I have been examined in the studies.

Further study is needed to considered the aggregate interference effects of multiple FSS satellite networks into Plan and List assignments.

One study concludes that coordination threshold triggered by a value of pfd at the geostationary orbit of -133.9 dBW / m² / MHz protects the assignments of the Appendix 30A Plan and List. Other studies conclude that an appropriate choice of the orbital position and coverage of a new FSS network may be sufficient to protect assignments of the Appendix 30A Plan and List.

* + - 1. FSS and FS

Provision of compatibility conditions between FSS (Earth-to-space) and FS stations in frequency band 14.5-14.8 GHz is possible based on coordination measures and application of territorial gap using RR Appendix 7 methodology.

In order to protect FS allocations from FSS (Earth-space) interference two step approach is proposed: identify coordination requirements on worst case calculation (RR AP7) and then calculate an actual required separation distance in reality conditions. Preliminary results showed that coordination with the terrestrial service of another country may not be necessary if FSS earth station placed far from the country borderline. Further, the coordination distance would be reduced significantly by having a minimum horizontal elevation angle of 5deg. One study shows that coordination distances are up to a few kilometers in practice. As the results of compatibility of FSS (space-to-Earth) and FS the masks for acceptable pfd from GSO FSS space stations in the direction to a FS station was defined. Limitation of pfd would be between
(–115 dB(W/m2·MHz)) and (–90 dB(W/m2·MHz)) for interfering signal arrival angles from 5º to 90º. The above pfd limitations would be more stringent for arrival angles below 5º where “main lobe‑to-main lobe” interference scenario is exist.

The compatibility studies between FSS and FS in frequency band of 14.8-15.35 GHz are also applicable to frequency band 14.5-14.8 GHz.

* + - 1. FSS and MS

Study shows that in order to protect the terrestrial MS operating in the 14.5-15.35 GHz band from the proposed FSS (Earth-to-space) allocation in ITU Region 1, an exclusion zone of 72 km around an MS station would be needed. Analysis based on Monte Carlo method indicates that land MS station protection criterion of an I/N of -6 dB is met only for 85% of the time for an terrestrial MS mobile station receiver at both 4 and 13 m in height.

In order to protect the AMS operating in the 14.5-15.35 GHz band from the proposed FSS (Earth-to-space) allocation in ITU Region 1, an exclusion zone in the range 100 to 500 km around an AMS station would be needed, depending on the altitude of the aircraft, respectively 2.4 and 19 km of altitude For an altitude of 19 km, Earth station power spectral density of -57 dBW/Hz results in a separation distance of 400 km, and Earth station power spectral density of -49.3 dBW/Hz results in a separation distance of 500 km. Analysis based on Monte Carlo method indicates that AMS station protection criterion is fulfilled only in 99.1% and 92.7% of time, with AMS receive station location at h = 19 and 2.4 km heights correspondingly.

This shows the interference environment and coordination provisions that exist today is the same that can be expected with any new FSS allocation in the 14.5-14.8 GHz band. Therefore, it could be conclude that sharing is feasible between FSS (Earth-to-space) and MS and AMS.

* + - 1. FSS and SRS

The frequency band 14.5-14.8 GHz is allocated to SRS on a secondary basis and used by SRS data relay satellite (DRS) systems for forward feeder links (Earth-to-GSO DRS) and for return inter-orbit links (NGSO user space crafts-to-GSO DRS). The technical characteristics of transmitting Earth and space stations and receiving DRS space stations presented in PDR Recommendation ITU-R SA.1414. The protection criteria for the various links of data relay satellite systems are provided in Recommendation ITU-R SA.1155.

Taking into account that the SRS DRS return links are restricted in bands above 14.8 GHz, it can be summarized that the compatibility between FSS (Earth-to-space and space-to-Earth) links and SRS in the band 14.5 14.8 GHz considering the same status for SRS and FSS is achievable with coordination measures.

* + - 1. Summary of studies for the band 14.5-14.8 GHz
		1. Frequency band 14.8-15.35 GHz

Editor note: The text in this section needs to be developed and finalized during the July 2014 meeting of WP 4A

* + - 1. FSS and FS

Analysis of FSS (space-to-Earth) interference to terrestrial FS stations showed that the probability of exceeding the long-term interference criterion Iag/N = −10 dB, without mandatory FS antenna beam deflection from exact GSO direction, varies from 3.92% to 0.45%. Under the assumption of FS antenna beam deflection from exact GSO direction by not less than 1.5 degree, the probability of exceeding the long-term interference criterion varies from 1.4% to 0.0014%.

Analysis of FS transmitter interference to FSS (space-to-Earth) receiver showed that FSS protection could be ensured by means of separation distance between transmitting FS TS and receiving FSS ES. Required protection for all types of receiving FSS ES from transmitting FS TS can be provided at separation distances 135-205 km (probability of worst case scenario varies from 0.0094% to 0.014%) to 23.7 km (probability of corresponded scenario 53.8%) depending on the mutual azimuth orientation of the FS stations and the FSS Earth stations antenna axes.

The compatibility studies between FSS and FS in the band of 14.5-14.8 GHz are also applicable to the band 14.8-15.35 GHz.

* + - 1. FSS and MS

The compatibility studies results between FSS and MS in frequency band 14.8-15.35 GHz are the same as in frequency band 14.5-14.8 GHz.

* + - 1. FSS (Earth-space) and SRS

The frequency band 14.8-15.35 GHz is allocated to SRS on a secondary basis and used by SRS DRS systems for return inter–orbit links (NGSO user spacecraft-to-GSO DRS) and forward feeder links (earth stations-to-GSO DRS). The technical characteristics of transmitting earth stations, NGSO space stations and receiving GSO DRS space stations presented in PDR Recommendation ITU-R SA.1414. The protection criteria for the various links of DRS systems are provided in Recommendation ITU-R SA.1155.

The frequency band 14.8-15.35 GHz is also used by SRS systems for data transmit from spacecraft to earth stations. These missions are limited in number with an estimated three to five satellites per year worldwide, and will generally be either in a low-polar orbit or in an equatorial orbit with some at geostationary altitudes or in the highly elliptical Earth orbit (HEO) and others at the L1 or L2 libration points. The characteristics of the GSO, low-orbiting and highly elliptical-orbiting SRS satellites transmitting in the space-to-Earth direction are reflected in the Recommendation ITU-R SA.1626.

DRS return links and FSS downlinks in the band 14.8-15.35 GHz demonstrate mutual compatibility using coordination measures, e.g. orbital separation.

Based on the assumptions of the study and current technical parameters of the reference FSS system, sharing between FSS uplinks and DRS return links in the band 14.8-15.35 GHz is not possible without mitigation techniques.

Further compatibility studies between FSS (uplinks and downlinks) and SRS system downlinks are required.

* + - 1. Summary of studies for the band 14.8-15.35 GHz

Editor’s Note: The text in this section needs to be developed and finalized during the July 2014 meeting of WP 4A

* + 1. Frequency band 15.35-15.4 GHz
			1. Summary of studies for the band 15.35-15.4 GHz

Frequency band 15.35-15.4 GHz is excluded from consideration because of RR 5.340.

* + 1. Frequency band 15.4-17.0 GHz
			1. FSS (Earth-space and space-Earth) and RLS

For FSS (Earth-space) case Study 1 shows that in order to protect RLS stations operating in the 15.4-17.0 GHz band a separation distance of up to 420 km or more (not accounting for terrain obstruction) requires and describes a non-uniform area around a radiolocation receiver where the protection criteria is exceeded. For fixed, ground-based RLS systems (as opposed to airborne RLS systems), assuming I/N ≤ -6 dB the required separation distances may be reduced down to ranges between 5 to 53 km if the FSS earth station PSDs are reduced to values range from –55 dBW/Hz to –60 dBW/Hz, and if there are horizon obstruction losses. The receiver in the radiolocation system can either be fixed or mobile. In addition, since the main beams of such RLS systems can point toward the GSO, FSS space stations may be subject to unacceptable levels of interference over periods of time from RLS systems operating under the existing primary allocation in this band.

For FSS (space-Earth) case Study 1 shows that in order to protect FSS receiving earth stations in the 15.4-17 GHz band from radiolocation system transmissions, a separation distance of up to 435 km (not accounting for terrain obstruction) requires describes a non-uniform area around a FSS receiving earth station receiver where the protection criteria is exceeded. This study determined that a PFD of –142 dBW/m2-MHz would protect radiolocation system receivers, which is more restrictive than PFD limits applicable in nearby bands.

* + - 1. FSS (Earth-space) and ARNS in 15.4-15.7 GHz band

The band 15.4-15.7 GHz is allocated to ARNS systems on a primary basis in all three ITU Regions. In accordance with RR No. 4.10, Member States recognize that the safety aspects of radio navigation and other safety services require special measures to ensure their freedom from harmful interference; it is necessary therefore to take this factor into account in the assignment and use of frequencies. With respect to proposed allocation to the FSS (Earth-to-space), one study shows that a separation distance of up to 486 km is required in order to protect Aeronautical landing systems (ALS) receivers from transmitting FSS earth stations. ALS transmitter can also cause interference to a GSO space station receiver. Study between ALS transmitter and receiving GSO satellite shows that up to 42 dB antenna discrimination is needed to GSO satellite antennas to avoid interference from ALS.

Based on the results sharing between ALS and FSS (Earth-to-space) is not feasible.

* + - 1. FSS and NGSO FSS (Earth-space) (MSS feeder links) in 15.4-15.7 GHz band

TBD

* + - 1. FSS and RAS operation in the adjacent frequency band

The emissions in the frequency band 15.4-15.7 GHz can cause interference to RAS receive station operating in the adjacent frequency band 15.35-15.4 GHz. In accordance with Recommendation ITU-R RA.769 the interference at RAS receiver input in 50 MHz shall not exceed –202 dBW (‑219 dBW/MHz accordingly) in the frequency band 15.35-15.4 GHz.

* + - 1. Summary of studies for the band 15.4-17 GHz

Editor’s Note: The text in this section needs to be developed and finalized during the July 2014 meeting of WP 4A

* + 1. IV. Summary table of preliminary study results under AI 1.6 WRC-15

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  FB,  GHzService | 10.0-10.5 | 10.5-10.6 | 10.6-10.68 | 13.25-13.4 | 13.4-13.75 | 14.5-14.8 | 14.8-15.35 | 15.4-15.43 | 15.43-15.63 | 15.63-15.7 | 15.7-16.6 | 16.6-17.0 |
| New FSS | ↓ | ↑ | ↓ | ↑ | ↓ | ↑ | ↓ | ↑ |  | ↓ | ↑ |  | ↓ | ↑ | ↓ | ↑ | ↓ | ↑ | ↓ | ↑ | ↓ | ↑ | ↓ | ↑ | ↓ | ↑ |
| FS | on going | TBD | on going | TBD | on going | TBD | TBD1 | TBD1 | on going | on going | on going | on going | on going | on going |  |  |  |  |  |  | TBD | TBD | TBD | TBD |
| MS except AMS | TBD | TBD | TBD | TBD | TBD | TBD |  |  | TBD | TBD | on going | on going | on going | on going |  |  |  |  |  |  | TBD | TBD | TBD | TBD |
| AMS | TBD | TBD | TBD2 | TBD2 |  |  |  |  | on going | on going | on going | on going |  |  |  |  |  |  |
| RLS | TBD | TBD | on going  | TBD | TBD | TBD |  |  | on going | on going |  |  |  |  | on going | on going | on going | on going | on going | on going | on going | on going | on going | on going |
| RNS |  |  |  |  |  |  |  |  | on going | TBD |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ARNS |  |  |  |  |  |  | on going | on going |  |  |  |  |  |  | TBD | on going | TBD | on going | TBD | on going |  |  |  |  |
| FSS | ↑ |  |  |  |  |  |  |  |  |  |  | TBD | on going |  |  |  |  | TBD | TBD | TBD3 | TBD3 |  |  |  |  |
| ↓ |  |  |  |  |  |  |  |  |  |  |  |  |  |  | TBD3 | TBD3 | TBD4 | TBD4 | TBD3 | TBD3 |  |  |  |  |
| RAS | on going 5 | TBD5 | on going5 | TBD5 | TBD | TBD |  |  |  |  | TBD5 | TBD5 | TBD5 | TBD5 | TBD5 | TBD5 | TBD5 | TBD5 | TBD5 | TBD5 |  |  |  |  |
| EESS (p) |  |  |  |  | on going | on going |  |  |  |  |  |  | TBD6 | TBD6 |  |  |  |  |  |  |  |  |  |  |
| EESS (a) |  |  |  |  |  |  | on going | on going | on going | on going |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SRS (p) |  |  |  |  | TBD | TBD |  |  |  |  |  |  | TBD6 | TBD6 |  |  |  |  |  |  |  |  |  |  |
| SRS (a) |  |  |  |  |  |  | on going | on going | on going | on going |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SRS |  |  |  |  |  |  |  |  | on going | on going | on going | on going | on going | on going |  |  |  |  |  |  |  |  | TBD7 | TBD7 |
| Am.S | TBD8 | TBD8 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SFTSS (↑) |  |  |  |  |  |  |  |  | on going | on going |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | – frequency band is not allocated to the radio service; | TBD | – no study is provided; |  | – this band is proposed to be excluded according preliminary CEPT position  |
|  | – frequency band is allocated on a primary basis; | On going | – study in progress; |  | – frequency bands proposed to be consider to finalize the study at priority order; |
|  | – frequency band is allocated on a secondary basis; |  |  | . | – interference with existing FSS systems operating in adjacent unplanned bands is possible when new and existing FSS systems are used at the same satellite (frequency separation about 300 MHz is required) |

1. Frequency band 13.25-13.75 GHz is allocated to FS only in Banglades, India, and Pakistan according to 5.499 RR.
2. Aeronautical mobile service (AMS) is allocated only in frequency band 10.5-10.55 GHz.
3. FSS systems may operate in the bands 15.4-15.43 GHz and 15.63-15.7 GHz in the space-to-Earth direction and 15.63-15.65 GHz in the Earth-to-space direction according to 5.511D RR.
4. Frequency band 15.43-15.63 is allocated to FSS (space-to-Earth) according to 5.511A RR.
5. Adjacent band compatibility is considered.
6. Frequency band 15.20-15.35 GHz is allocated to SRS (passive) and EESS (passive) on a secondary basis according to 5.339 RR.
7. Frequency band 16.6-17.1 GHz is allocated to SRS (deep space) (Earth-to-space).
8. Frequency band 10.45-10.5 GHz is also allocated to amateur-satellite service on a secondary basis.
1. Results of these studies are given in Report ITU-R М.2221, Report ITU-R М.2170, Report ITU-R.2229 and CPM Report for WRC-12 [↑](#footnote-ref-1)